Instruction Handbook for ....

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I.D. 50454

AIL Type 7006 DIODE NOISE GENERATOR AND AIL Type 7112 DIODE NOISE GENERATOR POWER SUPPLY

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CUTLER-HAMMER

AIRBORNE INSTRUMENTS LABORATORY
DEER PARK, LONG ISLAND, NEW YORK

CONTROL AIL DIVISION

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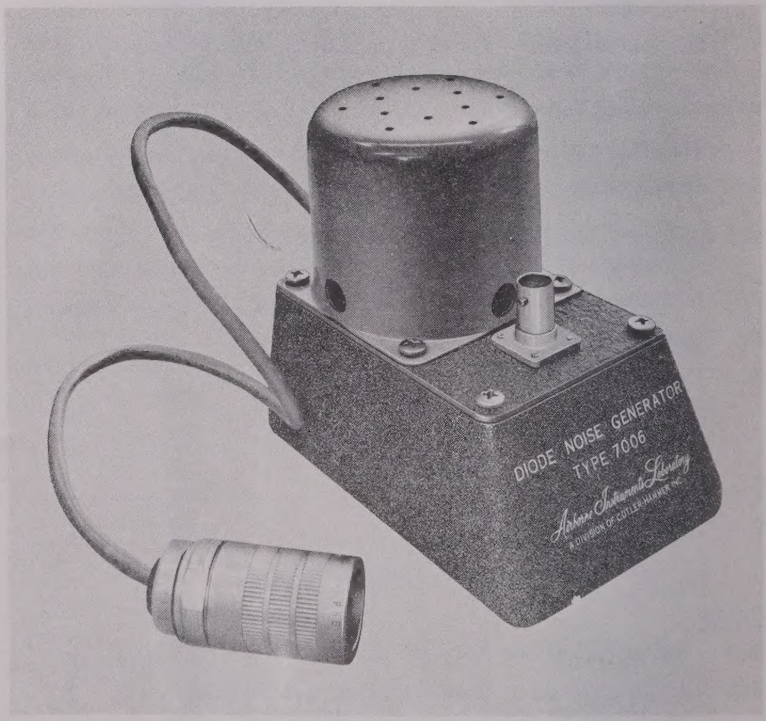

FIGURE 1-1. TYPE 7006 DIODE NOISE GENERATOR

PART I
TYPE 7006
DIODE NOISE GENERATOR

I. INTRODUCTION

The Type 7006 Diode Noise Generator (Figure 1-1) can generate excess noise power in the 10 to 250 Mc range. A 5722 diode is used as the noise source. Sufficient plate voltage is applied to ensure temperature-limited operation.

Power for the 7006 is obtained from either the AIL Type 74 Automatic Noise Figure Indicator or Type 7112 Diode Noise Generator Power Supply. When used with the Type 74 Automatic Noise Figure Indicator, either manual or automatic measurement of noise figure can be made.

When used with the Type 7112 Power Supply, manual measurement of noise figure from 0 to 16 db can be made.

II. SPECIFICATIONS*

Frequency Range:	10 to 250 Mc
Relative Excess Noise Ratio:	0 to 16 db
Noise Output Connection:	Type BNC
SWR:	1.15:1
Output Impedance:	50 ohms nominal

Size:

Length:	4-1/2 inches	Height:	4-1/2 inches
Width:	3-1/8 inches	Weight:	1-1/2 pounds

* Subject to change without notice.

III. OPERATING INSTRUCTIONS

A. MANUAL OPERATION WITH TYPE 7112 POWER SUPPLY

1. Set up the equipment as shown in Figure 1-2.
2. Connect the power cable of the 7006 to the 7112.
3. Connect the 7112 to 117 VAC power.

CAUTION

The Type 5722 Electron Tube has a life expectancy of about 200 hours at full output. To conserve tube life, turn the diode current control to minimum or preferably disconnect the Noise Generator when not in use.

4. Turn diode CURRENT control fully counterclockwise.
5. Turn power ON. Allow five (5) minutes warm-up.

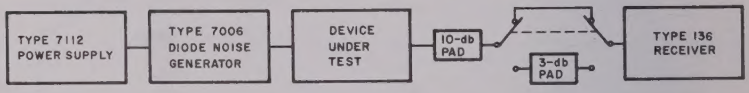

FIGURE 1-2. EQUIPMENT SETUP BLOCK DIAGRAM FOR TESTING

6. With the diode CURRENT control set in the extreme counterclockwise position, the output meter indicates the ambient-noise power level of the system. Record this reading.
7. Switch the 3-db pad into the circuit and adjust the diode CURRENT control until the output meter reads exactly the same value recorded. The noise figure of the receiver is then read directly on the panel meter of the 7112.

B. MANUAL AND AUTOMATIC OPERATION WITH TYPE 74 AUTOMATIC NOISE FIGURE INDICATOR

Refer to the Instruction Manual for Type 74 Automatic Noise Figure Indicator for operating instructions.

IV. THEORY OF OPERATION

The Type 7006 Diode Noise Generator consists of a filament type vacuum diode. The diode is operated at a plate voltage high enough to cause plate-current saturation (temperature-limited operation); under these conditions the DC plate current is virtually independent of plate voltage and is solely determined by the cathode emission. The excess noise power output (the ratio of available noise power of the diode to that of a pure resistance) is given by

$$T_e = \frac{e}{2KT_o} IR \qquad (1)$$

where

T_e = available excess-noise power output (usually expressed as a temperature ratio)

e = the electronic charge (1.59×10^{-19} coulomb)

K = Boltzmann's constant (1.38×10^{-23} joule/degree)

T_o = the reference temperature ($290^{\circ}K$)

I = DC plate current in amperes

R = terminating resistance in ohms.

The term $\frac{e}{2KT_o}$ is about equal to 20. Since R is known (50 ohms in the standard 7006), T_e can be easily determined by a simple DC current measurement.

The noise figure of a network can be determined by connecting its input to the noise-diode output and measuring the ratio of network noise-power output with the diode on, to that with the diode off. This ratio is called the Y factor. The network noise figure is then given by

$$F = \frac{T_e}{Y - 1} \qquad (2)$$

$$F = \frac{20\,IR}{Y - 1} \qquad (3)$$

There are two measurement methods in general use. The first is called the Y factor or constant excess noise method. Term I is set at some fixed level and Y measured by turning the diode on and off. F can then be computed from the equation. The second is the constant Y factor or the 3-db method. The noise output level of the network with the diode turned off is noted. The diode is then turned on, and Id increased until the noise output is exactly doubled. Y, therefore, is equal to 2, and equation 3 reduces to

$$F = 20\,IR \tag{4}$$

The following expresses this result in db:

$$F_{db} = 10 \log 20\,IR \tag{5}$$

V. MAINTENANCE

No preventative maintenance is required for the 7006. A schematic (Figure 1-3) and a replacement parts list (Section VI) have been included to assist in routine troubleshooting. If it is necessary to return equipment to the factory for repairs, use the following procedure.

RETURN OF EQUIPMENT TO FACTORY FOR REPAIRS

If it has been found necessary to return the equipment to the manufacturer for repairs, please write first to the AIL Sales Department, giving complete information concerning the nature of the failure and the manner in which the equipment was used when failure occurred. Also provide the TYPE AND SERIAL NUMBERS of the unit. Special instructions will then be supplied to the customer for shipping the unit back for repairs. All equipment should be packed and shipped, in accordance with the instructions supplied, with transportation charges prepaid. A failure report should accompany shipment of the equipment.

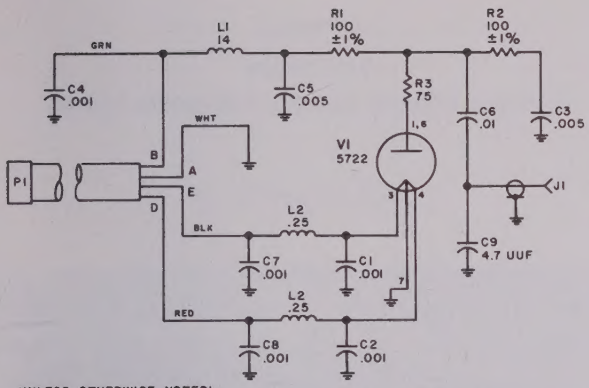

FIGURE 1-3. NOISE DIODE SCHEMATIC DIAGRAM

VI. REPLACEABLE PARTS LIST

Symbol	Description	Mfr.	Part No.
C1, C2, C4, C7, C8	Capacitor, ceramic, 0.001 μf	Cornell-Dubilier	59TM601
C3, C5	Capacitor, ceramic, 0.005 μf	Aerovox	BLS-1B
C6	Capacitor, paper, 0.01 μf	Erie	CC62
J1	Connector	Amphenol	UG-290A/U
L1	Choke, 14 μh	Speers Carbon Co.	10102-1
L2, L3	Choke, 0.25 μh	Speers Carbon Co.	10100-1
P1	Connector, power	Amphenol	165-33
R1, R2	Resistor, fixed, 100 ohms	Mepco	EP-012
R3	Resistor, fixed, 75 ohms	Allen-Bradley	EB7505
V1	Tube, electron	Sylvania	5722
XV1	Socket, tube	Sylvania	7470-0060

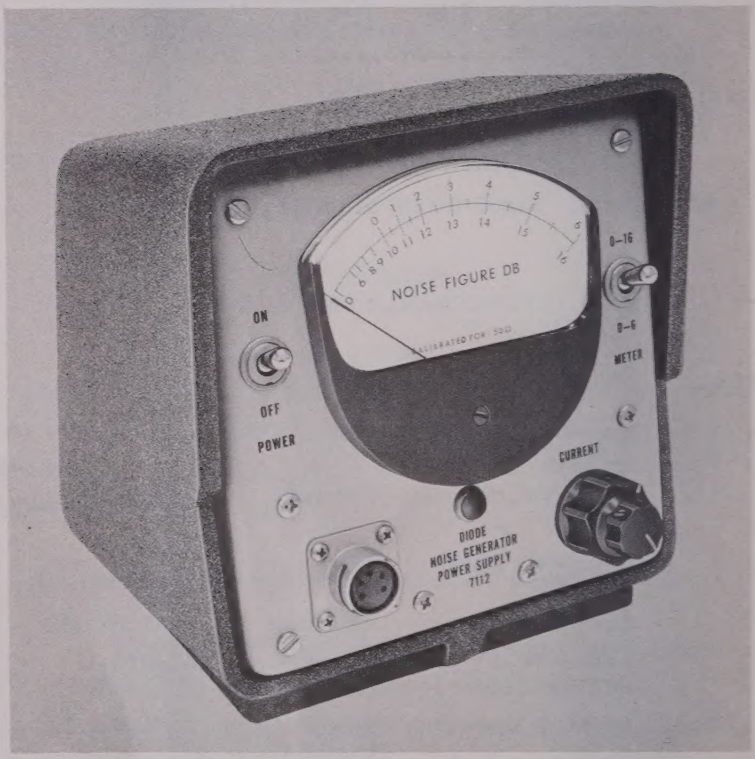

FIGURE 2-1. DIODE NOISE GENERATOR POWER SUPPLY

PART II

TYPE 7112

DIODE NOISE GENERATOR POWER SUPPLY

I. INTRODUCTION

The AIL Type 7112 Diode Noise Generator Power Supply (Figure 2-1) is designed to operate the Type 7006 Diode Noise Generator for manual noise figure measurements. The panel meter is calibrated in db, thus permitting noise figure to be read directly.

II. SPECIFICATIONS*

Power Input:		117 v, 50 to 60 cps, 1 amp
Power Output:		Filament and plate power for 5722 noise diode
Size:	Height:	7 inches
	Width:	7 inches
	Length:	7 inches
Weight:		7 pounds

* Subject to change without notice.

III. OPERATING INSTRUCTIONS

A. OPERATING CONTROLS (FIGURE 2-2)

Ref	Symbol	Description	Function
1	S1	POWER ON-OFF switch	Turns power on and off
2	S2	METER switch	Selects meter scale
3	R6	CURRENT control	Adjusts plate current
4	I1	Pilot light	Indicates primary power on
5	J1	Power connector	Provides power connection for Diode Noise Generator

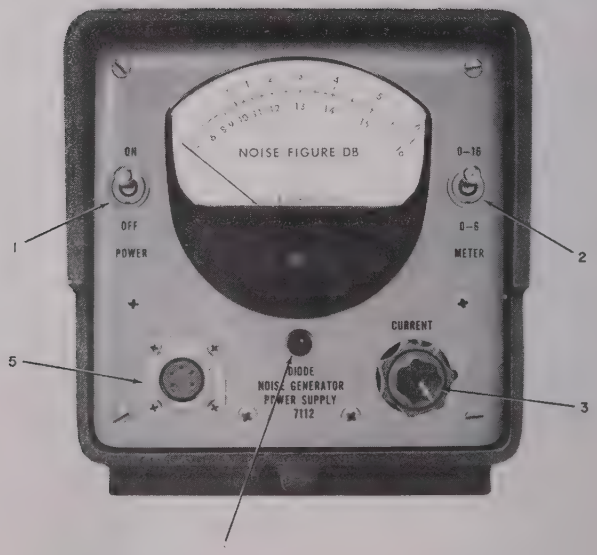

FIGURE 2-2. DIODE NOISE GENERATOR POWER SUPPLY OPERATING CONTROLS AND INDICATORS

B. OPERATION

1. Connect Diode Noise Generator to J1.
2. Turn Current Control fully counterclockwise.
3. Set meter switch to 0-6 db position.
4. Connect line cord to power line.
5. Turn POWER switch ON.
   Allow five (5) minutes warm-up.
6. Proceed with noise figure measurements as described on page 2.

IV. MAINTENANCE

No preventative maintenance is required for the 7112.

The meter shunt calibration procedure is performed as follows:

1. Set up equipment as described in operating instructions (Section III).
2. After five (5) minutes warm-up, adjust CURRENT control for full-scale deflection of the panel meter.
3. Switch METER switch to 0-16 db position.
4. Adjust R3 for 6-db reading on panel meter (Figure 2-3).

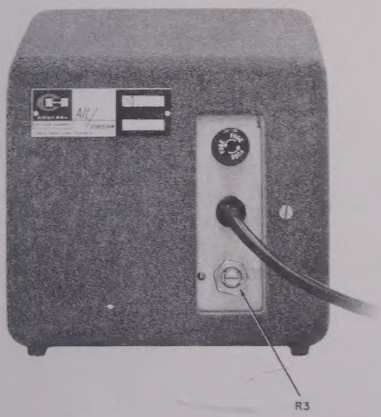

FIGURE 2-3. DIODE NOISE GENERATOR POWER SUPPLY REAR VIEW

A schematic (Figure 2-4) and Replaceable Parts List (Section V) have been included to assist in routine troubleshooting.

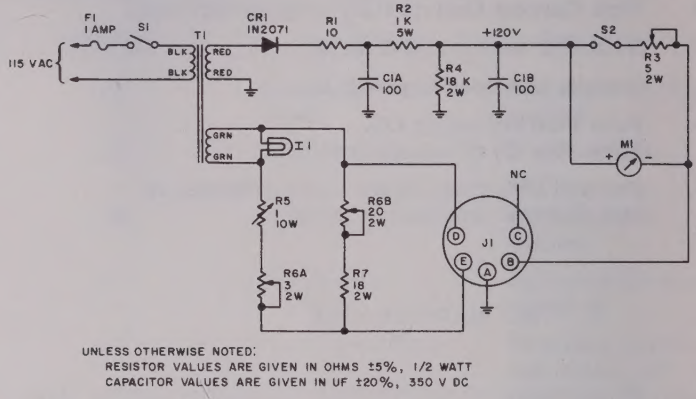

FIGURE 2-4. DIODE NOISE GENERATOR POWER SUPPLY SCHEMATIC DIAGRAM

If it is necessary to return the equipment to the factory for repairs, follow the instructions given on page 4

V. REPLACEABLE PARTS LIST

Symbol	Description	Mfr.	Part No.
C1	Capacitor, electrolytic, 2 × 100 μf,350 v	Sprague	TUL-2641
CR1	Diode	Texas Instruments	1N2071
F1	Fuse 1A	Bussmann	MDL-1
I1	Lamp	GE	47
J1	Connector, power	Amphenol	165-36
M1	Meter, panel	AIL	119862
R1	Resistor, fixed, 10 ohms, 1/2 w	Allen-Bradley	RC 20G F100J
R2	Resistor, fixed, 1 k, 5 w	Ohmite	7/8-C-54-F
R3	Resistor, variable	AIL	118090-1
R4	Resistor, fixed, 18 k, 2 w	Allen-Bradley	RC42GF183J
R5	Resistor, variable, 1 ohm, 10 w	Ohmite	1001
R6	Resistor, variable	AIL	116713
R7	Resistor, fixed, 18 ohms, 2 w	Allen-Bradley	RC42GF180J
S1, S2	Switch	C-H	8280K15
T1	Transformer, power	Stancor	PA8421